

### **Abstract of the Disclosure**

Linux's NAT (Network Address Translator) implementation, IP Masquerade, includes a VPN Masquerade feature that provides interoperation of NAT with IKE and ESP tunnel mode within the IPSec security protocol suite.

- 5 VPN Masquerade uses heuristics to route packets from a server on the Internet to a client on a local network that shares access to the Internet with other clients over a common access link through a router running NAT. VPN Masquerade, however, is susceptible to crashes, collisions and race conditions that can disable IPSec communication. These are prevented, or recovery from such is
- 10 automatically effected, by sending over a tunnel a control packet, a "ping", from the client at one end of the tunnel to the server at the other end of the tunnel, and then waiting to send any packets other than a control packet over the tunnel until a responsive control packet is received from the server. The tunnel is defined by an epoch that comprises one security association (SA) in each
- 15 direction that has a negotiated limited lifetime and defines the use of the ESP protocol in tunnel mode with negotiated authentication and/or encryption keys and a security parameters index (SPI) chosen by the SA's destination. If the client does not receive a response to the "ping" within a predetermined time, then it re-"pings" the server up to a predetermined number of times and, if no
- 20 response is received, rekeys the tunnel. Further, the client "pings" the server if no packet is received on a tunnel for a predetermined period of time. By also configuring the server to wait to switch to a new epoch until it receives a "ping" from a client, certain race conditions can be eliminated. Alternatively, the client can be configured to ignore an attempt by the server to start a negation for
- 25 rekeying the tunnel. Automatic recovery from a crash of the NAT is also provided by automatically starting a new IKE session if attempts to rekey a tunnel are not successful.